CONTEXT-PRESERVING DISPLAY SYSTEM USING A PERSPECTIVE SHEET

This is a Continuation of application Ser. No. 08/144,238, filed Oct. 27, 1993, now abandoned.

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CROSS REFERENCE TO RELATED APPLICATIONS

A related application in the field of visual displays of information, U.S. application Ser. No. 08/143,323, filed Oct. 26, 1993 entitled "IMAGE LENS" is assigned to the same assignee as the present application, and is incorporated herein by reference for all purposes.

BACKGROUND OF THE INVENTION

The present invention relates to the field of visual displays of information. More specifically, the invention solves the problem of presenting an image which cannot be displayed at full resolution on a display device without total loss of either details or context information.

An image is a visual display of information, or a logical representation of what is to become a visual display of information. One type of image is a text image. The information content of a text image is in the text of the image, but is also in the placement of the text in the image. For an image to be useful to a viewer, it must be displayed on a display device in such a way that the information content can be conveyed to the viewer. If the entire image can be displayed on the display device at the full resolution of the image, then no information is lost. However, information is often lost where a choice must be made between showing only a portion of the image at a minimum resolution which still allows the details to be seen, or showing the entire image at a resolution which shows the global patterns of the image but loses the details. Significant loss of detail in a text image would make the text unreadable.

The resolution limitations of a display could either be due to the fineness of the display or the ability of the viewer to see fine features. For example, if two lines cannot be resolved into two lines on a pixelated display device, they will appear as a single line. The merger of the lines could be due to either the inability of the display to use separate pixels for the two lines or the inability of a viewer to see the separate pixels of the two lines.

The image, when it is to be displayed on a display system such as a pixelated computer monitor, is usually stored in a digital computer as a collection of objects in a form understandable by a display system which, given an ideal display, might be displayable in their entirety. This stored form of the image, or the "full" image, by definition contains all of its information content. Examples of stored forms are bit maps (as in a low-end drawing program or photoediting system), object list files giving object characteristics and positions (as in a CAD system), vector image files, or text in the form of characters and formatting codes.

The loss of information in an image occurs when the image is to be displayed on a display which cannot display

all the information of the full image. For example, if a bit map comprises more pixels than are available on the display, the display could not show the image, and a substitute image, such as a lower resolution image of the bit map or a portion of the bit map is all that can be displayed. What is displayed when a full image cannot be displayed is referred to herein as a "substitute" image.

Several systems for generating substitute images for a particular display device from a full image have been proposed. In one such system, the substitute image is a "window" into a portion (less than all) of the full image and the system provides the viewer a means for moving the window "over" the full image. Most word processors use this system. In a word processor, the typical full image is a document which is too long to be displayed on a display screen in its entirety. The substitute image provided by the word processor is a window into the document, typically 25 lines or so, and the window is moved over the document with commands such as "page down", "page up", "line down", etc.

Several word processors also include a "page view" mode, which shows how the text appears on full pages of the text document. Even with a single page document, the characters of text cannot be discriminated where the display device is a conventional computer monitor. Of course, an image of a one-page document can be fully displayed where the display device is a high resolution printer, but even a printer cannot display an image of a document of many pages in full detail.

Another type of substitute image is the split image, where one part of the displayed substitute image shows a global and less detailed view of the full image and another part of the displayed substitute image shows a detail subimage of a subregion of the full image in the necessary detail. This approach is less than desirable, since the detail subimage is detached from the global context, and consequently a viewer will need to jump back and forth visually between the global and detail images to observe both the details and the context of the information presented. In the above example of a word processor, a split image would leave a viewer of a document with no ability to read a phrase and also see where it is found in the full image.

Another split screen approach uses a substitute image which is a global image partially magnified by a magnifying glass (a physical one or one which is implemented electronically) to view details of a subimage of interest. This suffers the same problem as the previous split screen example because the connection between the global image and the detailed subimage is lost. Furthermore, with a magnifying glass, more of the global image is obscured than is shown in the magnified detail subimage.

This magnifying glass problem is illustrated in FIG. **1**. FIG. **1** shows three views of a document image **10**. Although the full image **10** used in this example is actually displayable, for any practical application, the full image would contain too much text to be displayable in its display frame.

FIG. **1**(*b*) shows the effect of magnification of a region **13** of image **10** into a detail image **14**, which is effected by magnifier **12**. As a result of the magnification of region **13**, other areas of image **10** are obscured, and the context of detail image **14** is lost due to the discontinuity between region **13** and image **10**. Note that the discontinuity occurs at the edge of magnifier **12**.

The obscuring and loss of context occurs with both physical magnifiers and logical magnifiers, and the cause is